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(71) Applicant
Hauni-Werke Korber & Co K G (FR Germany),
Kampchaussee 8–30, 2050 Hamburg 80, Federal Republic of Germany

(72) Inventor
Norbert Lange

(74) Agent and/or Address for Service
Wheatley & Mackenzie,
Scottish Life House, Bridge Street, Manchester M3 3DP

(54) Optically testing rod-shaped tobacco products

(57) Apparatus for optically testing filter cigarettes 2 has a fluted drum 1 which transports a series of filter cigarettes at right angles to their respective axes toward, through and beyond a testing station 3 where the filter mouthpieces and the adjacent portions of successive filter cigarettes traverse a wide bundle of radiation 16 issuing from a laser 12 or another source and being widened by a system of lenses 13,13'. That portion of the bundle 16' which is not intercepted by an article at the testing station is reflected by one or more mirrors 17,17' or by a prism so that it traverses the testing station for a second time and then impinges upon one or more arrays of photosensitive diodes 11 whose outputs are connected to an evaluating circuit 21. The rays which are being propagated toward the mirrors or prism and the reflected rays are located in a plane which is normal to the axes of filter cigarettes at the testing station.

Fig. 1

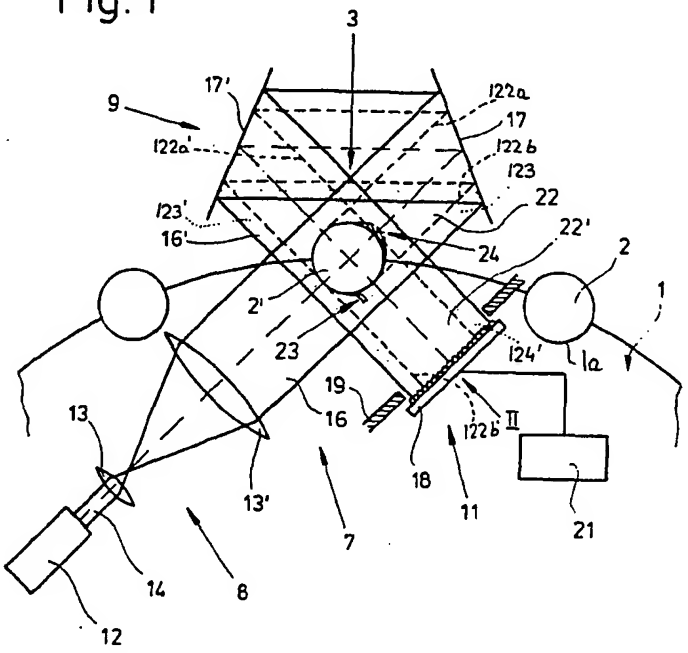

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Fig. 1

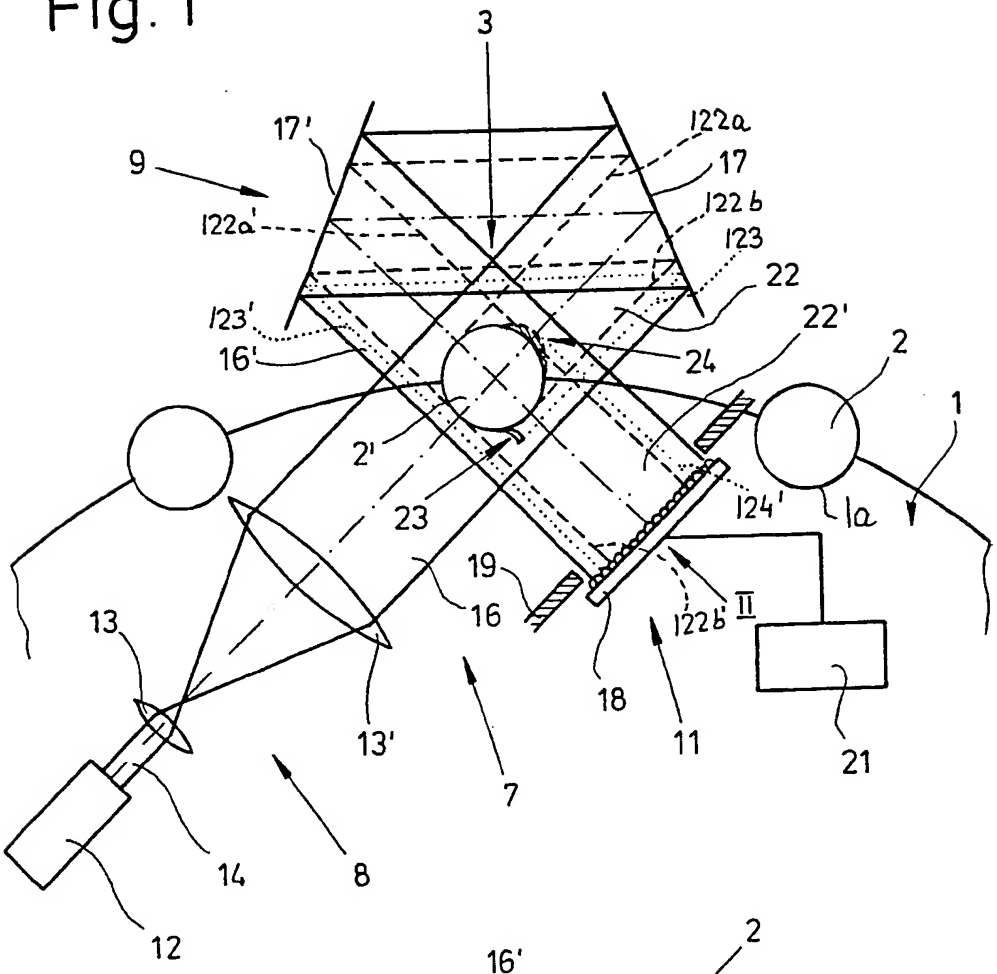

Fig. 2

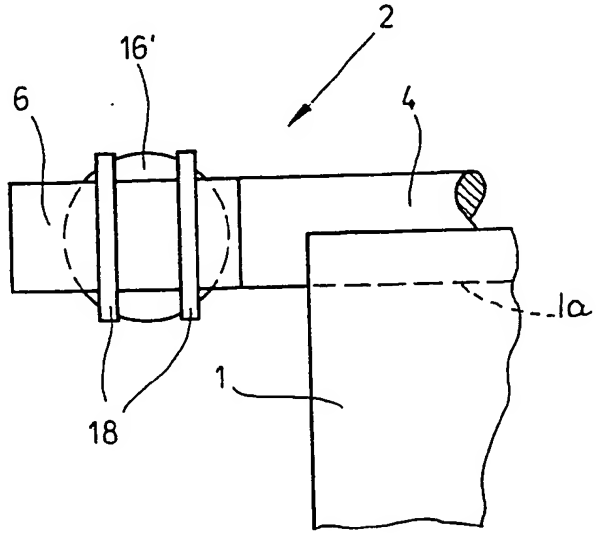

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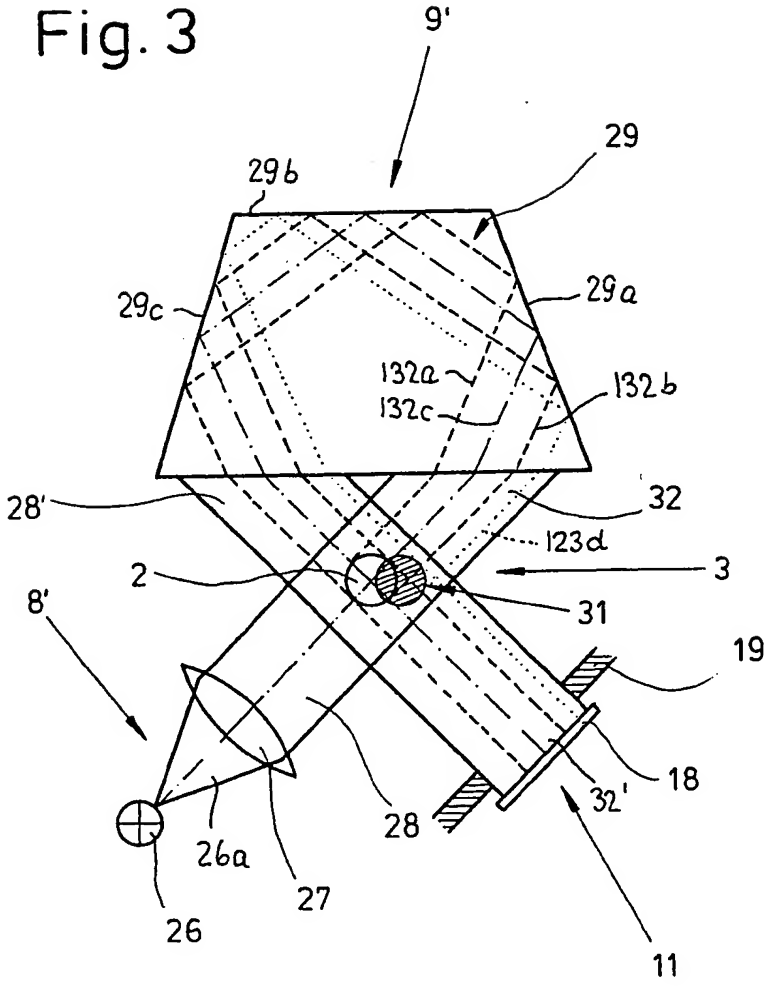
Fig. 3



SPECIFICATION

Apparatus for optically testing rod-shaped articles of the tobacco processing industry

The present invention relates to apparatus for optically testing rod-shaped articles of the tobacco processing industry. More particularly, the invention relates to improvements in apparatus for optically testing successive rod-shaped articles of the tobacco processing industry while a conveyor transports such articles sideways (i.e., at right angles to their respective axes and preferably in the form of a row containing a single layer of rod-shaped articles).

It is well known to optically test successive rod-shaped articles of the tobacco processing industry (e.g., filter cigarettes) by causing the articles to advance through a testing station where a radiation source directs a beam of radiation upon successive articles and the radiation which has advanced beyond the articles and/or which has been reflected by the articles impinges upon a photosensitive detector which generates signals denoting the quality of the tested articles. The radiation which has bypassed and/or which has been reflected by the articles at the testing station is indicative of various characteristics of the tested articles. Optical testing apparatus of the just outlined character are often used to monitor the quality of filter cigars, cigarillos or cigarettes; however, such apparatus can be used with equal advantage for the testing of a wide variety of other rod-shaped articles of the tobacco processing industry including plain cigarettes, cigars or cigarillos, filter rod sections and others.

Apparatus for optically testing filter cigars, cigarillos or cigarettes are often used to ascertain the presence or absence of filter mouthpieces, the quality of connections between the filter mouthpieces and the tobacco-containing portions of such articles, the presence or absence of bent or otherwise deformed articles, defects of uniting bands which consist of tipping paper or the like and are used to connect the filter mouthpieces with the tobacco-containing portions of articles and/or other types of defects. Detection of defects results in the generation of appropriate signals which are used for segregation of corresponding (defective) articles from satisfactory articles. For example, German Offenlegungsschrift No. 25 42 082 discloses an apparatus for optically testing filter cigarett s wherein several radiation sources direct b ams of radiation at different angles against the filter ends of successive filter cigarettes at the testing station, and th monitoring means of such apparatus comprises a discrete photocell for each radiation source. Testing of d fective filter cigarettes (e.g., articl s without filt r mouthpi c s, articles wherein the filter mouthpieces are improperly attached to the tobacc - containing portions, undesirable deformation of tobacco-containing portions and/or filter mouthpieces or improperly bonded uniting bands) entails that the photocells receive different amounts of radiation (i.e., more light or less light than during testing of satisfactory articles), and the photocells then generate signals which are used for segregation of defective articles from satisfactory articles.

A drawback of the apparatus which is disclosed in the just discussed German printed publication is its complexity, bulk and inability to invariably and reliably detect all such defects which are likely to be found in rod-shaped articles of the tobacco processing industry and could be irritating to the manufacturer and/or to the consumer.

One feature of the invention resides in the provision of an apparatus for optically testing cigarettes or other rod-shaped articles of the tobacco processing industry, especially for testing filter cigarettes for the presence or absence of filter mouthpieces, improper application of mouthpieces to the tobacco-containing portions and other defects. The apparatus comprises means (e.g., a rotary drum-shaped conveyor having a series of axially parallel peripheral flutes for reception of portions of articles to be tested) for transporting a succ s- sion of articles at right angles to the axes of the articles and along a predetermined course so that the articles form a single layer, irradiating means including means for directing a bundle of parallel rays from one side of the course against successive articles in a predetermined portion (testing station) of the course, means for reflecting the bundle of parallel rays from another side of the course opposit the one side and back against the articles at the testing station, and optoelectrical detector means located in the path of propagation of the reflected bundle of rays and serving to generate signals denoting the characteristics (e.g., intensity) of rays subsequent to repeat d passage of such rays across the testing station.

The irradiating means can include a radiation source (e.g., one or more lasers) which is arranged to emit a relatively narrow beam of rays, and the directing means then includes means for widening and for thereby converting the narrow beam into the aforemention d bundle. The bundle (prior as well as subsequent to reflection) is preferably located in a plane which is at least substantially normal to th axes of the articles at the testing station. The reflecting means can include a plurality of mirrors or a totally reflecting prism. The orientation of reflecting means with refer nce to the irradiating means is or can be such that the bundle of rays which ar being propagated to the refl cting means and the bundle of rays which ar being propagat d toward th d tector means make an angle which

equals or approximates 90 degrees. The detector means can comprise at least one of arrays (preferably a linear array) of diodes, and the directing means of the irradiating means can comprise a system of optical lenses.

Another feature of the invention resides in the provision of a method of optically testing rod-shaped articles of the tobacco processing industry, such as filter cigarettes. The method comprises the steps of transporting a succession of at least substantially parallel articles one after the other in the form of a single layer and at right angles to their respective axes along a predetermined course or path, directing a bundle of parallel rays from one side of the course against successive articles in a predetermined portion of the course, reflecting the bundles of parallel rays from the other side of the course opposite the one side back into the predetermined portion of the course for renewed impingement upon the articles, and monitoring the characteristics of the bundle of rays subsequent to such renewed impingement upon the articles.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

FIG. 1 is a schematic side elevational view of an apparatus which embodies one form of the invention and wherein the reflecting means comprises two mutually inclined mirrors adjacent to one axial end of a drum-shaped conveyor which transports filter cigarettes toward, through and beyond the testing station;

FIG. 2 is a fragmentary side elevational view of the conveyor and a fragmentary side elevational view of a filter cigarette at the testing station as seen in the direction of arrow II in FIG. 1; and

FIG. 3 is schematic side elevational view of a modified testing apparatus wherein the reflecting means includes a totally reflecting prism.

FIGS. 1 and 2 show an optical testing apparatus which embodies one form of the invention and comprises a rotary drum-shaped conveyor 1 constituting a means for transporting a series of rod-shaped articles 2 along an arcuate course or path toward, through and beyond a testing station 3 which constitutes a portion of such course. The conveyor 1 has a number of equidistant axially parallel peripheral flutes 1a each of which receives a portion of the respective article 2. If the articles 2 are filter cigarettes, they are preferably transported in a manner as shown in FIG. 2, i.e., the flute 1a receives only the major part of the tobacco-containing portion 4 whereas the filter mouthpiece 6 and the uniting band which connects the mouthpiece 6 with the tobacco-containing portion 4 extend beyond an axial end of the conveyor 1. This renders it possible to test the entire mouthpiece 6 as well as the adjacent part of the respective tobacco-containing portion 4.

The testing apparatus of FIGS. 1 and 2 further comprises a group 7 of three units including an irradiating unit 8, a reflecting unit 9 and an optoelectrical detector means or monitoring unit 11. The irradiating unit/8 comprises a radiation source 12 (e.g., a helium-neon laser) and means (including an optical system composed of lenses 13 and 13′) for directing a relatively wide bundle 16 of parallel rays across the testing station 3 so that the rays of such bundle impinge upon a predetermined length of the article 2 at the testing station. The relatively narrow bundle 14 of radiation which is emitted by the laser 12 is widened by the lens 13, and the lens 13′ converts such divergent bundle into the aforementioned rather wide bundle 16 of parallel rays.

The reflecting unit 9 of the apparatus which is shown in FIGS. 1 and 2 comprises two mutually inclined mirrors 17 and 17′. It will be noted that the irradiating unit 8 is disposed at one side of the course which is defined by the flutes 1a of the conveyor 1 and that the mirrors 17, 17′ are disposed at another side of such course opposite the unit 8. The positions of the mirrors 17 and 17′ with reference to the irradiating unit 8 are selected in such a way that the mirror 17 reflects the bundle 16 against the mirror 17′ and the latter reflects the bundle across the testing station 3 so that the thus reflected bundle 16′ and the bundle 16, whose rays propagate themselves toward the mirror 17, make an angle of approximately or exactly 90 degrees. The rays of the bundle 16′ impinge upon the monitoring unit 11 subsequent to renewed passage across the testing zone 3.

The monitoring unit 11 includes at least one but preferably several linearly arranged arrays of diodes 18 which are located in the path of propagation of rays which form the reflected bundle 16′ and are capable of bypassing the article 2 at the testing station 3 subsequent to their reflection by the mirror 17′. FIG. 2 shows two linear arrays of diodes 18. In order to establish more predictable testing conditions, the rays of the reflected bundle 16′ must pass through a diaphragm 19 on their way toward the light-sensitive surfaces of the diodes 18. The outputs of the diodes 18 are connected with the corresponding inputs of a conventional evaluating circuit 21 which evaluates the signals from the diodes 18 and, if necessary, generates defect signals for segregation of defective articles 2 from satisfactory articles.

The mode of operation of the apparatus of FIGS. 1 and 2 is as follows: When an article 2' to be tested reaches the testing station 3 (i.e., that portion of the course defined by the flutes 1a of the conveyor 1 which is traversed by the rays of the bundle 16), the evaluating circuit 21 is ready to receive signals from the diodes 18, i.e., the testing operation can begin. That portion of the article 2' which extends beyond one end face of the conveyor 1 (note FIG. 2) then enters the path of propagation of the rays which form the bundle 16 and such article intercepts a certain percentage of rays to form in the bundle 16 a shadow region 22 bounded in FIG. 1 by two parallel broken lines 122a, 122b. The thus modified bundle 16 carries or contains information concerning the quality of the tested portion of the article 2' at the station 3 because the dimensions of the shadow region 22 can indicate whether or not the diameter of the tested portion of the article is too small or excessive and/or whether or not the article 2' includes a filter mouthpiece 6. The remainder of the bundle 16 (i.e., the original bundle 16 minus the portion which was intercepted by the article 2' to allow for the establishment of the shadow region 22) impinges upon and is/reflected by the mirror 17 and thereupon by the mirror 17' so that it again traverses the testing station 3 in the form of a bundle 16' which makes an angle of approximately or exactly 90 degrees with the bundle 16. The shadow region 22 (now shadow region 22') remains unchanged. The reflected bundle 16' impinges upon the same portion of the article 2' which was exposed to the rays of the bundle 16 except that the bundles 16 and 16' impinge upon different parts of the external surface of such portion. The width of the shadow zone 22 matches the diameter of the article 2' as "seen" by the lens 13, and the width of the shadow zone 22' immediately ahead of the arrays of diodes 18 matches the diameter of the article 2' as seen from the mirroc 17' in a direction toward the monitoring unit 11. The width of the shadow zone 22' matches the width of the shadow zone 22 if the article 2' at the testing station 3 is satisfactory, i.e., if the tested portion of such article is round. In such instance, the arrays of diodes 18 receive an amount of radiation which enables them to generate signals denoting that the tested article 2' is satisfactory, i.e, the evaluating circuit 21 does not generate a defect signal and the article 2' is not segregated from other articles. The manner in which defective rod-shaped articles can be segregated from satisfactory articles in response to signals which an evaluating circuit transmits to a pneumatic or other suitable ejecting device is described and shown in the commonly owned U.S. Pat. No. 4,280,187 granted july 21, 1981 to Reuland et al.

Let it be assumed that the outer or overlapping marginal portion 23 of the convoluted uniting band of tipping paper which attaches the filter mouthpiec 6 to the tobacco-containing portion 4 of the article 2' at the testing station 3 extends substantially radially outwardly from the other marginal portion so that it constitutes a flap or flag which intercepts a certain amount of radiation forming the bundle 16. The flap 23 is shown in FIG. 1 in the path of propagation of certain rays from the lens 13' toward the mirror 17. This flap causes a widening of the shadow region 22 as indicated in FIG. 1 by a dotted line 123. Such widening of the shadow region 22 (which then extends between the broken line 122a and the dotted line 123) is not eliminated by the mirror 17 and/or 17' so that the amount of radiation which impinges upon the diodes 18 of the two arrays is reduced accordingly. In other words, the shadow region 22' then extends between the lines 122a' and 123'. The signals from the diodes 18 induce the evaluating circuit 21 to generate a defect signal which is utilized to effect segregation of the article 2' from the preceding and from the next-following satisfactory articles. It will be noted that the improved testing apparatus can immediately and reliably react to the presence of the flap 23 even though this flap is detected only once, namely by the bundle 16 while its rays are being propagated from the lens 13' toward the mirror 17. In other words, the flap 23 need not interfere with the propagation of radiation which forms the bundle 16'; nevertheless, its presence is detected by the improved apparatus and the signals which are generated by the diodes 18 inform the evaluating circuit 21 of the defect.

The reference character 24 denotes in FIG. 1 a deformation of the tested portion of the article 2'. The deformation can constitute a bulge in the filter mouthpiece 6, /in the adjacent end of the tobacco-containing portion 4 or only in the tubular envelope which is formed by the uniting band and connects the mouthpiece 6 with the portion 4. It will be seen that the defect (deformation) 24 is located in the shadow region 22, i.e., it does not affect the bundle 16 and, therefore, such defect would remain undetected if the mirror 17 were replaced by a monitoring unit. However, the defect 24 affects the width of the shadow region 22' in the reflected bundle 16', i.e., the width of the shadow region 22' is increased so that this shadow region then extends between the broken line 122b' and the dotted line 124' of FIG. 1. In other words, the amount of radiation which impinges upon the diodes 18 is reduced and their signals to the evaluating circuit 21 induce the latter to generate a defect signal which is used to segregate the article with the defect 24 from satisfactory articles.

It will be seen that the improved apparatus can readily detect defects which do not affect

th bundle 16 but do affect th bundle 16′ or vic versa. Of course, th positions of certain d fects can b such that they influenc th bundl 16 as well as the bundl 16′. For example, such situation will arise if the article at the testing station 3 lacks a filter mouthpiece 6 or if a bulge in the part that extends beyond one axial end of the conveyor 1 and into the range of the bundles 16, 16′ is so pronounced that it causes a widening of the shadow region 22 as well as a widening of the shadow region 22′, not because of but independently of prior widening of the region 22.

FIG. 3 shows a portion of a modified testing apparatus with the conveyor for rod-shaped articles 31 omitted. The irradiating unit 8′ comprises a source 26 of divergent (rather than coherent) radiation 26a, and such radiation is converted into a bundle 28 of parallel rays by a suitable optical element 27. The latter is a lens or a system of lenses which directs the bundle 28 against that portion of the article 31 which is located at the testing station 3.

The reflecting unit 9′ of FIG. 3 comprises a totally reflecting prism 29. The unit 8′ is located at one side and the unit 11′ is located at the other side of the course or path for the articles 31 toward, through and beyond the testing station 3, and the units 8′, 11′ are disposed at least substantially opposite each other. The mutual positions of the reflecting surfaces 29a, 29b, 29c of the prism 29 are selected in such a way that the reflected bundle 28′ which issues from the prism crosses the non-reflected bundle 28 at an angle of approximately or exactly 90 degrees. The monitoring means 11 of the apparatus of FIG. 3 is or can be identical with the similarly referenced monitoring means of FIG. 1. The boundaries of the bundle 28 in the interior of the prism 29 are not specifically shown for the sake of clarity.

FIG. 3 shows that, if the tested portion of the article 31 at the station is out of position, e.g., due to the presence of a bend or buckle in the respective portion of such article, the apparatus need not necessarily react to the detection of such deformation in the same way as in response to the detection of a defect which warrants segregation of the respective article 31. Thus, all that happens is that the shadow region 32 in the bundle 28 behind the testing station 3 is shifted from its anticipated or normal position (between the lines 132a, 132b) to a different position (betw n th lines 132c, 132d). Th width of the shadow region 32′ is the bundl 28′ b hind the article 31 is th sam as that of the shadow region 32 and the t tal amount of radiation which reaches the diodes 18 behind the diaphragm 19 is th same as if the article 31 were straight (i.e., as if the article 31 were as straight as the satisfactory article 2 which is shown in FIG. 3 at the t sting station 3 for convenience of comparison. Of course, if the deformation of th article 31 is so pron unced that th width of th shad w region 32 is l ss than shown, the diodes 18 transmit appropriate signals indicating that the amount of radiation impinging thereon is excessive and the evaluating circuit (not shown in FIG. 3) then effects the segregation of the corresponding article 31 from the course or path which is defined by the conveyor of the testing apparatus or by a conveyor which receives tested articles from the testing apparatus. The sensitivity of the apparatus in this respect (for the purpose of detecting bent or buckled portions of tested articles) can be increased by reducing the width of the bundles 28 and 28′ so that such width only slightly exceeds the diameters of the articles 31.

If the improved testing apparatus is to ascertain defects which are positioned in such a way that they do not influence the bundles 16, 16′ or 28, 28′, the articles can be tested more than once, e.g.,' by installing a second testing apparatus upstream or downstream of the testing apparatus of FIG. 1 or 3 and by ensuring that the angular position of the irradiating means in the second testing apparatus deviates from the angular position of the unit 8 or 8′ with reference to the course or path of the articles which are transported toward, through and beyond the testing stations. As a rule, the provision of a single testing apparatus will suffice to ensure reliable detection of all pronounced defects. The provision of two or more testing apparatus, one after the other, even more reliably ensures the detection of all defects which would affect the quality and/or appearance of the tested articles to an extent warranting their segregation from other articles.

An important advantage of the improved testing apparatus is its simplicity and compactness. Thus, a single irradiating unit suffices to ensure the detection of defects which could not be detected by a bundle of rays which traverse the testing station (and are influenced by the portion of the article at the testing station) only once. The provision of th reflecting unit opposite the illuminating unit and of the monitoring means 11 opposite the reflecting unit ensures a more economical utilization of radiation which issues from the source 12 or 26 and greatly enhances the versatility and sensitivity of the improved testing apparatus. The reflecting unit 17, 17′ or 29 ensures that the bundle 16 or 28 can gather additional inf rmation concerning th quality of the article 2′ or 31 at th testing stati n 3 b f r such information is transmitt d to th monitoring m ans 11 and thence to the evaluating circuit.

The utilization of bundles (16 or 28) whose width exceeds the diameters of the tested articles is d sirable and advantageous b caus

this ensures that at l ast s me radiation is invariably reflect d by th mirr rs 17, 17′ r by the prism 29 and can be influenced by one or/more defects during propagation from the mirror 17′ or surface 29c toward the monitoring means 11. Those portions of the bundles 16, 16′, 28 and 28′ which traverse the testing station 3 include centrally located portions which are intercepted by the articles at the testing station to form the shadow regions 22, 22′, 32 and 32′ as well as marginal portions which pass tangentially along the articles at the testing station on their way toward the reflecting unit or toward the monitoring means. This results in two-dimensional monitoring of articles 2′ or 31 for the presence or absence of defects which warrant segregation of tested articles from other (satisfactory) articles.

The feature that the bundles 16, 16′ and 28, 28′ are located in planes which are at least substantially normal to the axes of the articles at the testing station 3 contributes to compactness of the improved testing apparatus.

If the radiation source is or includes a laser or one or more lasers, it is presently preferred to employ a helium-neon laser because coherent radiation which is emitted by such source can be readily expanded or widened so that the width of the resulting bundle of rays (such as the bundle 16 shown in FIG. 1) can readily exceed the diameters of the tested articles but the thus expanded bundle still contains sufficient amounts of energy to enable the apparatus to carry out highly reliable tests.

The provision of a reflecting unit which comprises or constitutes a totally reflecting prism (such as the prism 29 of FIG. 3) simplifies the assembly of the apparatus because the mutual positions of the reflecting surfaces 29a, 29b and 29c are fixed whereas thg positions of the mirrors 17, 17′ might require adjustment during assembly of the apparatus in order to ensure that the mirror 17 will reflect all such rays of the bundle 16 which advance beyond the testing station 3 and that the mirror 17′ will reflect toward the diodes 18 all such rays of the bundle 16′ which advance beyond the testing station.

The aforediscussed presently preferred orientation of the irradiating means and reflecting means relative to each other in such a way that the bundles 16, 16′ and 28, 28′ cross each other at an angle of 90 degrees or close to 90 degre s ensures that the apparatus can scan practically the entire external surface of that portion of the article 2′ or 31 which is locat d at the t sting stati n 3. It has been found that, at least in most instanc s, a single testing apparatus with such mutual p sitioning of the irradiating and reflecting units suffices t ensure reliable detection of all defects which warrant detection, especially protruding porti ns of uniting bands, the abs nce f filt r mouthpieces, excessive bending or buckling f the articles, protrusions f the articles and/or others.

The provision of monitoring means that utilizes one or more arrays of diodes, especially linearly arranged diodes, is desirable and advantageous if the apparatus is to detect bent or buckled articles, i.e., articles whose positions at the testing station deviate from the anticipated or optimum positions.

An important advantage of both illustrated embodiments of the improved apparatus (and all equivalent apparatus) is that those portions of the article 2′ or 31 which require testing can be examined during a single pass through the testing station 3 because the dimensions of the bundles 16 and 28 are such that each such bundle can impinge upon a selected axially extending portion of the article 2′ or 31 and across the full width of such selected axially extending portion (e.g., across the entire filter mouthpiece 6 and the adjacent part of the tobacco-containing portion 4 as well as across the entire convoluted uniting band which connects the mouthpiece and the tobacco-containing portion to each other).

Another important advantage of the improved testing apparatus is that it need not utilize more than one irradiating unit and/or more than one monitoring means. This contributes to simplification of the evaluation of signals which are transmitted by the single monitoring means and this also contributes to lower cost of the testing apparatus. Thus, not only the mechanical and optical components but also the electronic components of the improved apparatus are fewer and simpler than in conventional optical testing apparatus which employ several light sources and discrete monitoring means for each light source. In spite of its simplicity and compactness, the improved apparatus can invariably and readily detect all such defects which require detection in order to avoid the sale of inferior products as regards their quality and/or appearance.

CLAIMS

1. Apparatus for testing rod-shaped articl s of the tobacco processing industry, comprising means for transporting a succession of articles at right angles to the axes of the articles along a predetermined course; irradiating means including means for directing a bundle of parallel rays from one side of said course against successive articles in a predetermined portion of said course; means for r flecting said bundle of rays from another side of said course opposit said one sid and back against th articl s in said portion of said course; and opto l ctrical d tector means located in the path f propagation of the reflected bundle of rays and arranged to generate signals denoting the characteristics of rays subsequent to repeated passage of such rays across said p rtion of said course.

2. The apparatus of claim 1, wherein said irradiating means includes a radiation source arranged to mit a relativ ly narrow beam of rays and said dir cting m ans incl des means for converting said narrow beam into said bundle.

3. The apparatus of claim 1, wherein said bundle is located in a plane that is at least substantially normal to the axes of articles which are being transported along said course.

4. The apparatus of claim 1, wherein said irradiating means further comprises a radiation source and said source includes or constitutes a laser.

5. The apparatus of claim 1, wherein said reflecting means comprises a totally reflecting prism.

6. The apparatus of claim 1, wherein the orientation of said reflecting means with reference to said irradiating means is such that the bundle of rays which are being propagated toward said reflecting means and the bundle of rays which are being propagated toward said detector means make an angle which equals or approximates 90 degrees.

7. The apparatus of claim 1, wherein said detector means comprises at least one array of diodes.

8. The apparatus of claim 1, wherein said array is a linear array.

9. The apparatus of claim 1, wherein said directing means includes a system of lenses.

10. The apparatus of claim 1, wherein said reflecting means comprises a plurality of mirrors.

11. A method of optically testing rod-shaped articles of the tobacco processing industry, comprising the steps of transporting a succession of at least substantially parallel articles one after the other in the form of a single layer and at right angles to their respective axes along a predetermined course; directing a bundle of parallel rays from one side of said course against successive articles in a predetermined portion of such course; reflecting the bundle of parallel rays from the other side of the course opposite the one side back into the predetermined portion of the course for renewed impingement upon the articles; and monitoring the characteristics of the bundle of rays subsequent to such renewed impingement upon the articles.

12. Apparatus for testing rod-shaped articles of the tobacco processing industry, substantially as herein described with reference to the accompanying drawings.

13. A method of optically testing rod-shaped articles of the tobacco processing industry, substantially as h rein describ d with r ferenc to th accompanying drawings.

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